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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/002,862	11/15/2001	John Davis Holder	MEMC 01-0650 (3003)	4783

321 7590 07/26/2005

SENNIGER POWERS LEAVITT AND ROEDEL
ONE METROPOLITAN SQUARE
16TH FLOOR
ST LOUIS, MO 63102

EXAMINER	
SONG, MATTHEW J	
ART UNIT	**PAPER NUMBER**
1722	

DATE MAILED: 07/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/002,862	HOLDER, JOHN DAVIS	
	Examiner	Art Unit	
	Matthew J. Song	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 May 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-102* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-102* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-102 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holder et al (US 5,588,993) in view of Kamio et al (US 5,087,429).

In a method of preparing a molten silicon melt, note entire reference, Holder teaches polycrystalline silicon **10** is loaded into a crucible **20** and chunk poly crystalline silicon is used because using chunks avoids the formation of void defects (col 3, ln 35 to col 4, ln 2). Holder also teaches polycrystalline silicon **10** is melted until a partially melted charge forms in a crucible (col 4, ln 30-65). After forming the partially melted charge in the crucible, granular polycrystalline silicon **40** is fed onto the exposed unmelted polycrystalline silicon (col 5, ln 1-60). Holder also teaches feeding the polycrystalline silicon **40** on the unmelted silicon **11** allows the silicon to dehydrogenate, which is desirable (col 5, ln 10-30). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Nagai with Holder's method of feeding polycrystalline silicon onto the exposed unmelted polycrystalline to allow the polycrystalline silicon to dehydrogenate before becoming immersed in the molten silicon, which is desirable (col 3, ln 1-15).

Holder et al does not teach intermittent feeding.

In a method of manufacturing silicon single crystals, Kamio et al teaches continuously or intermittently feeding a silicon starting material so as to maintain constant the liquid level of the molten material (col 1, ln 5-67), this reads on applicant's intermittent delivery comprising on and off periods.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Holder by using the feeding apparatus taught Kamio for feeding the silicon intermittently to control a desired flow of silicon material.

Also, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Holder by using an intermittent flow because there are only two types of flow, intermittent or continuous, as evidenced by Kamio et al and the selection of one known equivalent technique for another may be obvious even if the prior art does not expressly suggestion the substitution, *Ex parte Novak* 16 USPQ 2d 2041 (BPAI 1989).

Referring to claim 4-5, the combination of Nagai et al and Holder teach the interface between the unmelted polycrystalline silicon and the upper surface of the molten silicon is approximately equidistant from the center of the unmelted polycrystalline and equidistant from the interior wall of the crucible ('993 Fig 3).

Referring to claim 1, the combination of Holder and Kamio et al teach a feed tube **42** in a crucible, note Figure 2 of Holder et al.

Referring to claims 6-8, the combination of Holder and Kamio et al teach 55 kg of chunk polycrystalline for a 100 kg total charge ('993 col 5, ln 5-15); therefore the percentage of chunk polycrystalline can be determined to be 55% (55/100), which reads on applicant's range of 50-60%.

Referring to claim 9-10, the combination of Holder and Kamio et al teaches the molten silicon comprises about 25-50% of the total surface area ('993 col 4, ln 45-65 and Figs 2-4), this reads on applicant's d ranges about 65%-85% of D.

Referring to claim 11-12, the combination of Holder and Kamio et al teach rotating the crucible ('429 col 6, ln 45-60).

Referring to claim 13-14, the combination of Holder and Kamio et al does not teach rotating at about 2.1 rpm. The rate of crucible rotation is dependant on the flow rate of the feed pipe. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Holder and Kamio et al by optimizing the rotation speed of the crucible to obtain same by conducting routine experimentation of a result effective variable (MPEP 2144.05). Also, rotating a crucible at 2 rpm is well known in the art, note Nagai et al (US 5,868,835) below. Furthermore, the selection of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)).

Referring to claim 15-18, the combination of Holder and Kamio et al teaches a feed rate of 5-15 kg/hr ('993 claim 14).

Referring to claim 19-31, the combination of Holder and Kamio et al is silent to the value of the f, t_{on} and t_{off} parameters. The combination of Holder and Kamio et al teaches intermittent feeding ('429 col 1) and the feeding of the silicon is such that a constant level is maintained ('429 col 1). Therefore, the amount of time for commencing and stopping the flow and the flow rate of silicon are result effective variable, which control the thickness of the unmolten layer. It would have been obvious to a person of ordinary skill in the art at the time of the invention to

modify the combination of Holder and Kamio et al by optimizing these parameters to obtain same by conducting routine experimentation (MPEP 2144.05).

Referring to claim 32, the combination of Holder and Kamio et al is silent to using an angle of repose valve. Angle of repose valves are conventionally used for granular materials in order to interrupt the flow of granular material. Angle of repose valves are well known in the art, as evidenced by Crawley (US 5,642,751) and Boone et al (US 5,205,998), below.

Referring to claim 33-34, the combination of Holder and Kamio et al teaches a vertical type feed tube so that it is not directly above the center of he exposed unmelted silicon ('993 Figs 2-4).

Referring to claim 35, the combination of Holder and Kamio et al teaches a feed is sprayed ('993 Fig 2-3), this reads on applicant's spray type feed tube.

Referring to claim 36-52, the combination of Holder and Kamio et al is silent to portion of the exposed unmelted polycrystalline silicon upon which the granular polycrystalline silicon is delivered is a wedge that extends radially outward from about the center to the interface between the unmelted silicon and the upper surface of the molten silicon. However, the combination of Holder and Kamio et al teach rotating at a similar rate and flowing granular silicon intermittently, as applicant, therefore this is inherent to the combination of Holder and Kamio et al. The combination of Holder and Kamio et al also does not teach the wedge angle. The wedge angle is merely the size of the wedge. Changes in size and shape are held to be obvious (MPEP 2144.03).

Referring to claim 53-58, the combination of Holder and Kamio et al is silent to the position of wedges. However, the combination of Holder and Kamio et al teach rotating at a

similar rate and flowing granular silicon intermittently, as applicant, therefore this is inherent to the combination of Nagai et al and Holder.

Response to Arguments

3. Applicant's arguments, see page 23 of the remarks, filed 5/6/2005, with respect to Nagai et al have been fully considered and are persuasive. The rejection of claims 1-102 has been withdrawn. Nagai et al does not teach intermittent flow out of a feed tube in a crucible.

4. Applicant's arguments with respect to claims 1-102 have been considered but are moot in view of the new ground(s) of rejection. The selection of an intermittent process versus a continuous process would have been obvious to a person of ordinary skill in the art, as evidenced by *Ex parte Novak* 16 USPQ 2d 2041 (BPAI 1989).

5. Applicant's arguments filed 5/6/2005 have been fully considered but they are not persuasive.

Applicant's argument that the references teach away from each other is noted but is not found persuasive. The Examiner admits Holder is directed to a method of forming a melt, which involves supplying silicon via a feed tube to a crucible to increase the melt level and Kamio et al teaches a method of feeding silicon to maintain a melt level. Holder achieves a melt level increase by not removing silicon and Kamio et al achieves a constant melt level by removing silicon and supplying new silicon to maintain the melt level. The different intentions of Holder and Kamio do not constitute a teaching away, as suggested by applicant. The different results desired by Holder and Kamio are not because of the type of flow, intermittent or continuous.

There are only two options for supplying silicon to a crucible, continuously or intermittently. Using applicant's logic Kamio et al would teach away from continuous and intermittent feeding since both can be used to maintain the melt level (col1, ln 55-65). Both processes are conventionally known in the art, as evidenced by Kamio et al, and a person of ordinary skill in the art would have found it obvious to using an intermittent feeding to control a desired flow of silicon material. Holder et al does not teach away from intermittent flow. The selection of intermittent or continuous flow

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, a feed tube capable of controlling the rate of flow of silicon to a crucible by continuous or intermittent feed would be desirable to Holder et al because Holder teaches feed rate is a result effective variable (col 5, ln 30-45); therefore using the feed tube of Kamio et al would improve feed rate control.

Applicant's argument that Kamio et al teaches away from intermittent feeding is noted but is not found persuasive. Applicants allege that Kamio teaches the primary objective...is continuous feeding, note page 28-29 of the remarks. Patents are relevant for all that they contain and non-preferred embodiments constitute prior art, note MPEP 2123. Kamio teaches continuous feeding, however Kamio also teaches intermittent feeding is also known in the art.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ogure et al (US 5,820,649) teaches pelletized silicon material falls intermittently into a silicon melt (col 2, ln 55-65).

Barclay et al (US 5,569,325) teaches the addition of feed material over time can be carried out intermittently in which portion of the feed material are introduced at discreet intervals of time or continuously in which the feed material is being constantly metered.

Nagai et al (US 5,868,835) teaches rotating a crucible at 2 rpm while feeding silicon to silicon melt (col 5, ln 55-67).

Crawley (US 5,642,751) teaches angle of repose valves have typically been used for granular materials in order to interrupt the flow of granular material (col 1, ln 10-15).

Boone et al (US 5,205,998) teaches an angle of repose valve to block the flow for high purity silicon (col 1, ln 50-55 and col 2, ln 1-67).

Holder (US 5,919,303) teaches loading a crucible with chunk polysilicon and granular polysilicon (Abstract).

Fuerhoff (US 6,454,851) teaches a wedge and feeding granular polysilicon and feeding is controlled in response to the relative position to the sidewall of the crucible (Abstract).

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1722

MJS
July 21, 2005

ROBERT KUNEMUND
PRIMARY EXAMINER